

THE

Rick Fleeter, Editor
vol 9:3 - July, 1995

NEW SPACE

NEWSLETTER

Formerly: THE ISSO NEWSLETTER

INDUSTRY NEWS

SpaceVest adds two companies to portfolio

Analytical Graphics Inc. of King of Prussia, Pa. and Geophysical & Environmental Research (GER) Corp. of Millbrook, N.Y., recently received venture capital funds from SpaceVest Management Group, Inc. of Reston, Va.

Analytical Graphics produces commercial off the shelf (COTS) software aimed at enhancing the productivity of space industry professionals. Their popular Satellite Tool Kit (STK) and associated plug in modules are applicable to such tasks as orbit generation, scheduling ground station access, and displaying sensor coverage. The software runs on a number of workstation platforms and is also available as a programmers library for developers. In exchange for a \$2.5 million investment, SpaceVest will receive an equity stake and representation on Analytical Graphics' board of directors.

GER, a maker of ground and airborne sensors for agricultural and environmental monitoring, has announced plans to expand into space with a private constellation of six to eight small satellites. The GER Earth Resource Observation System (GEROS) would provide crop assessments to farmers worldwide at three day intervals. While GER's experience in the space industry is somewhat limited, the 40 person company has experience and contacts in the agriculture industries stretching back to 1978. The GEROS satellites would be able to pinpoint areas of crop stress, and provide information to assist farmers in the deciding when and where to apply water, fertilizers and pesticides. The entire system will cost on order of \$500 million to develop. The amount of capital provided by SpaceVest was not disclosed.

continued on page 7...

THE PEGASUS SAGA

by David Goldstein and Joshua Cohen

Pegasus, the winged white horse of ancient mythologies and traditions, has given way to the winged spaceship of the rocket age. However, just as the ancient Pegasus' life was not free from tragedy and intrigue, neither is the Orbital Sciences Corporation's (OSC) modern version. Thus far, the short life of the Pegasus XL rocket has been marked by headaches and heartaches for OSC and its customers. Two failures have cast a pall over the vehicle, and it remains to be seen what effect this will have on the industry niche the Pegasus was to fill and on OSC itself. Whatever the outcome, the story of Pegasus is one from which both industry and the government have lessons to learn.

In the early 80's, much of the rocket industry was being neglected by NASA due to increased reliance on the Space Shuttle. Orlando Figueroa, currently the Project Manager for NASA's Explorers Program and previously the Project Manager for the Small Explorers Program (a big Pegasus client) at Goddard Space Flight Center in Greenbelt, Md., explains that besides a few large, venerable launchers, there was virtually no market for expendable launch vehicles in the United States. With no market came no competition and little investment. The industry had stagnated and fallen behind. There was really no motivation for development and launch support for small satellites.

However, the Challenger accident of 1986 provided a shocking reality check for all involved. The Shuttle was simply not destined to be a commercial transportation vehicle, as was originally conceived. In its wake, a desire arose for more accessible and economical ways of using space, leading to a developing market for small satellites. Starting with a few leaders in industry and gradually spreading to the University world, the military, and to various research organizations, there evolved a small satellite industry and a need for launch vehicles for them. The Challenger accident derailed OSC's initial product, the Transfer Orbit Stage (TOS), a system used to transfer satellites from the Shuttle to higher energy orbits. OSC was able to take the blow in stride however, and in 1988 announced a partnership with Hercules Aerospace to develop the Pegasus air launched orbital launch vehicle. Privately funded development had already begun at this point, having secured a commitment from the Defense Advanced Research Projects Agency (DARPA) for six initial launches. The first of these DARPA launches took place in 1990 on the Pegasus rocket.

continued on page 4...

In This Issue...

Industry News	1
The Pegasus Saga	1
Letter from the Editor	2
Letter to the Editor... Ken Levenson	3
A Wrinkle in Microspace - Part 3	8

Letters • • • • •

From the Editor...



Newsletter Staff

Editor

Rick Fleeter

Managing Editor

Joshua Cohen

Contributing Writer

David Goldstein

The New Space Newsletter provides exclusive coverage of events and trends in the small and low cost space industry. It is published six times annually and mailed to New Space preferred members.

In addition to the Newsletter, preferred members receive privileges such as publishing online in the New Space Journal, Calendar, and Job Market. The cost for one year is just \$55. Start your membership today by contacting us at:

New Space Information Services
520 Huntmar Park Drive
Suite 100A
Herndon, VA 22070 USA

tel: +1 703-709-2240
800-636-4776 toll-free
fax: +1 703-709-0790
net: <http://www.newspace.com/>

© Copyright 1995, New Space Information Services. All rights reserved. Reproduction without permission is prohibited.

I enjoy trying to do things in different ways – it's my nature. Part of the attraction of small satellites was that – it was a chance to change the order of things and be revolutionary. But not for its own sake. I am a fervent believer in the value of space, and I believe the conventional approach to it has failed to bring those benefits to the widest possible community. I did my thesis in a tiny lab in a basement with about 2 co-workers, including my advisor. I enjoy small scale – the hands on, the informality, the ability to at least have the illusion of grasping the whole.

Adolf Thiel, an understudy of Werner Von Braun, took me under his wing at TRW and told me that he could never have risen to his status as Vice President in the TRW of the '80s. What excited him was building rockets with his own two hands. He didn't see a path for a young engineer to grow into a global perspective at the company – this was now in the hands of MBAs, lawyers and administrators. Pretty gloomy stuff for a young PhD all fired up about space, who wanted to really build spacecraft and rockets from the lab bench up (but didn't have much patience for viewgraph manufacture).

I have poured a lot into small satellites because I see it as a way to bring the benefits of space to many more people, and to benefit those of us who work in the space field as well. This new way of doing space has consumed my life for the last 15 years. I have quit 3 jobs (and induced my wife to quit one of hers), sold houses, moved across country and borrowed more money than I could ever hope to pay back, all in order to prove a hypothesis: that there is an alternative – a new way of doing space projects on a smaller, more efficient, and more individual scale. The International Small Satellite Organization (ISSO) was a product of my desire to make this movement to smaller, cheaper and more capable space systems really happen.

So it was that I started ISSO in 1987 as a 2 page newsletter with the goal of stimulating communications among the few members of the nascent small satellite community. Back then this amounted to a few radio hams, some academic and government types, (most of whom happened also to be radio hams) and just a few people at one or two very forward looking companies.

As some pretty fancy Amsats, NUSAT and GLOMR got launched, the Newsletter and its readership expanded, I recruited some part time help to get a more professional product out to several hundred readers, and I fretted about keeping up with the explosion of interest in small low cost space activity. Pretty soon I was not only pursuing my ISSO career but I also had taken up another very time consuming hobby – running a company building little satellites.

Five years ago, communications attorney Jill Stern, who has expertise in commercial space and new technologies, became interested in the potential of small satellites. At that time, her vision was that small satellites could address some of the technical and economic issues being faced by the space industry in the wake of the Challenger disaster. She suggested to me that the small satellite community could benefit from having an association and a Washington presence. We decided to pool our efforts under the ISSO name, which was already pretty well recognized. The result was a simple division of labor – Jill would pursue the industry association, the conference and lobbying efforts as her thing, and I'd stick to the newsletter and other communications media, and to building satellites.

That first ISSO conference happened in spring of '91 at the Watergate Hotel in Washington, DC with about one fourth of the attendance that we saw this year. While Jill and I meet often to confer and co-conspire, we each focus on what we like to do best. Jill has organized the ISSO board, she has created our Industry Organization, she has represented us in numerous national and international fora, and she consistently organizes an annual conference of the highest quality. Jill provides services tailored to the industry sponsors, including the newsletter *Small Space*, which addresses policy and regulatory issues and ISSO events.

Almost 2 years ago Josh Cohen joined me in the mission to continuously upgrade the ISSO newsletter. Improved graphics, layout, content, advertising and circulation are all thanks to Josh. He has expanded the newsletter effort to include a broader range of information services for the microspace community. We now support a very impressive World Wide Web site called the New Space Network. The site hosts an on-line version of

the Newsletter, often including color graphics, late breaking news, an online journal, a forum for reader feedback, and most importantly, a directory of companies supplying products and services to our industry. Next time you are working late at night to finish a proposal and suddenly realize you need a detailed drawing and specs for a momentum wheel or earth sensor, it's all there waiting for you on the Web. Josh also provides customized research and data services including market profiles and generation of research reports.

It seemed like a good idea to collect all of these services under one "brand" name which more vividly connotes the vision of a new way of doing space projects. That name is *New Space Information Services*, and you should be seeing a lot of it in the coming months, as it will grace the Masthead of our newsletter, web pages, and various other information products that come out of our Herndon, VA office.

I view New Space as interactive media, working globally to bring together individuals who share the vision of bringing space to a wider constituency. At the same time, we'll be working locally to help individuals and corporations build a custom online presence, which is a necessary part of any communications plan in this new global economy. If you are interested in taking advantage of our services, I invite you to browse through the New Space Network which is accessible 24 hours a day via Internet's World-Wide Web:

<http://www.newspace.com/>,

or during business hours, you can contact us by phone at +1 703-709-9362.

I hope you enjoy this inaugural issue of the New Space Newsletter, and I encourage you to take advantage of the expanding knowledge base that New Space has to offer.

Best Regards,



Rick Fleeter
Editor, New Space Newsletter
Founder and President, International Small
Satellite Organization (ISSO)



To the Editor...

We at the Institute for the Study of Earth, Oceans and Space at the University of New Hampshire appreciate the coverage that the ISSO newsletter has been dedicating to the STEDI program over the last year. We feel very strongly that this program will play an important role in future university space research involvement as well as provide a platform for demonstrating new technologies, methods and management procedures. A program such as STEDI has been long over due to demonstrate that real science can be done using focused missions for a fraction of the current NASA cost of producing scientific satellites.

There has been, however, no mention in your reporting that the University of New Hampshire's CATSAT STEDI mission was selected in the final competition as the third place winner behind Colorado and Boston University. In this role UNH has been awarded \$500,000 over a one year period to continue development of its program and also act as the backup to the two fully funded programs. USRA is monitoring the progress of the Colorado and BU programs as well as the one at UNH. If sufficient progress is not maintained by the two flight funded missions then UNH will be asked to take over that position.

The CATSAT Mission meets all of the objectives laid out during the inception of the STEDI program; it is an all university effort, has a large student and academic involvement, and is utilizing new technologies to make previously unmade measurements for a current and important astrophysical topic.

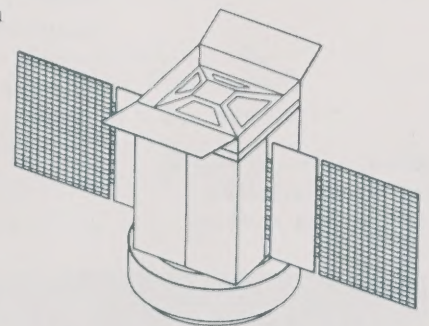
Sincerely,

Ken Levenson
CATSAT Deputy Principal Investigator
University of New Hampshire



Thanks Ken, for calling attention to an important fact which we overlooked in our most recent STEDI article. USRA's decision to select UNH as an alternate will at the least, put pressure on the two flight teams to meet their budget and schedule projections. We'll be checking in with USRA and the three STEDI teams again in the near future to see how their respective satellites are taking shape. Stay tuned!

- J.C.



Further Details of the CATSAT mission may be found at the University of New Hampshire's Small Satellite Lab World Wide Web home page:

<http://burst.unh.edu/ssl.html>

Looking back over the years, one finds that Pegasus was not the only vehicle to have difficulty during its development. In the table at right, a selection of orbital launch vehicles, organized by date of first launch, are compared. For this study, failure indicates that the vehicle did not reach Earth orbit. Also note that Pegasus has only launched seven times to date. These figures are a product of custom New Space research.

Another source for launch information is the Dept. of Transportation's STAR database which catalogs the successes and failures of many launch vehicles over their entire lifetime. From this source we note that many of the vehicles listed in the table at right have compiled a respectable success record among configurations that remain operational today. For example:

Atlas: 42 of 47
Long March: 30 of 34
Proton: 199 of 224
Ariane: 42 of 46

For more information about New Space custom research services, call 800-636-4776.

Below, a cutaway diagram of Pegasus reveals the vehicle's inner workings.

... "Pegasus", from page 1

Eventually, NASA picked up on the small satellite theme with Administrator Dan Goldin's goals of "smaller, faster, cheaper, better". No other small launch vehicles were in regular use at this time, and the rest of the launch industry wasn't prepared for the growing demand. This unpreparedness combined with the new (at least for NASA) desire to bring costs to a minimum led to several contract awards from NASA and the US Air Force for the Pegasus rocket in 1991. The technology and launch system was ready to be implemented, and more importantly, the rocket would be much cheaper than other existing dedicated launchers and able to be built and integrated in quantity. High development costs and a lack of customers kept other companies from entering the market with new rockets, and OSC soon became the only kid on the block with a launcher to support this new class of small payloads. By March, 1993, OSC had a backlog of 25 firm orders, plus 51 options for the Pegasus.

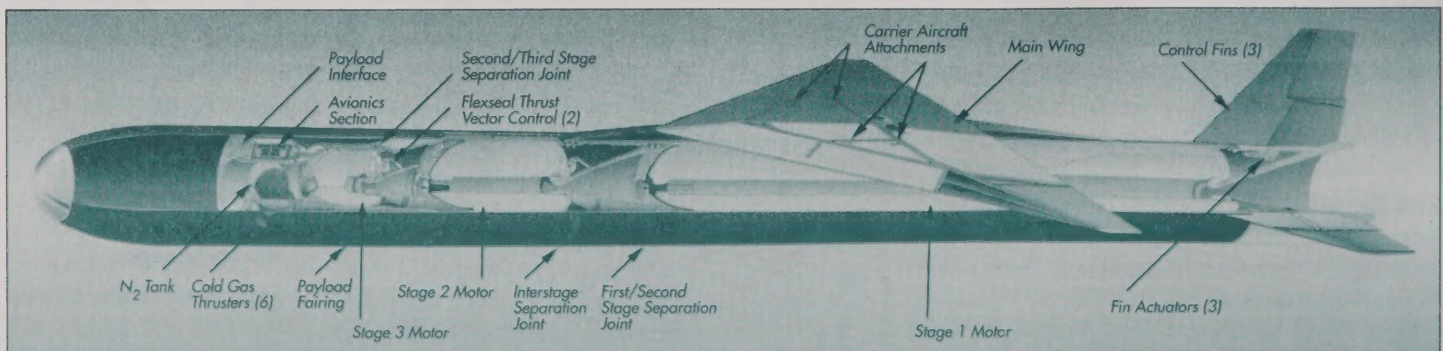
The first several flights are risky for any new launch vehicle, and the Pegasus is no exception. Until the kinks are ironed out of the system, launches bring with them much higher risks. Although several of these first Pegasus flights missed their mark, there were no outright failures of the vehicle. This built some confidence in the Pegasus system, and left NASA a bit unprepared for the first total mission loss in 1994. This failure came on the first flight of the Pegasus XL (for eXtended Length) which was carrying STEP-1, the third in the US Air Force's Space Test Experiment Platform (STEP) series (STEP-0 and STEP-2 were launched successfully on OSC's Taurus and Pegasus vehicles). The XL was launched on June 27, 1994 from an L-1011 based at Vandenberg Air Force Base, California. About 32 seconds into the flight, the Pegasus' nose began to pitch right and its wing rolled downwards. At 39 seconds, control was lost and one second later, telemetry was also lost. At 171 seconds, the vehicle was destroyed by the Range Safety Officer after stage two failed to ignite. An Anomaly Investigation Team consisting of experts from NASA, OSC, and elsewhere, found that errors in the aerodynamic model which was used by the guidance and control software on board Pegasus

Success Rate After First Ten Launches

Vehicle	First Flight	Failures	Country
Atlas	1958	6	U.S.
Scout	1960	3	U.S.
Delta	1960	1	U.S.
Titan	1964	1	U.S.
Cosmos SL-8	1964	1	Russia
Proton	1965	3	Russia
Tsyklon	1966	0	Russia
L-4S	1966	5	Japan
Long March	1970	4	China
N-1	1975	0	Japan
Ariane	1979	2	France
Zenit	1985	0	Russia
Pegasus	1990	2	U.S.

caused the failure. OSC never ran wind tunnel tests on the Pegasus XL vehicle. They chose to modify the standard Pegasus' computer model, instead of modeling the XL's aerodynamics from scratch. This was not sufficient to fully analyze the aerodynamics of the XL and according to Alan Sherman, Head of Engineering at NASA's Goddard Space Flight Center, certain aerodynamic coefficients were assumed which were inaccurate. NASA paid for wind tunnel testing and analysis at Langley Research Center in Virginia, corrected the model, and the Pegasus XL underwent a design certification review which checked the design of every component in the vehicle.

However, placing the entirety of the blame on the lack of wind tunnel testing skirts the real issue at hand... What sort of environment allows mistakes like this to be made? In the old days of rocket design, budgets were much less constraining, and it was not a problem to exhaustively test each new vehicle. But OSC does not have the huge government funding sources that some of these earlier rockets enjoyed during development stages. Instead, Pegasus development has relied almost exclusively on the private sector which has invested in the promise of a large backlog from government and commercial customers. Couple this with the fact that Pegasus is positioned as the 'low cost'





July 20, 1995

Dear Reader,

The space industry is changing. The largest players are consolidating, working to remain competitive in an atmosphere of shrinking government funding. In their wake, scores of small companies are springing up to pursue niche applications. In the past two years, an increasing number of small and low cost projects have spurred the development of a new space industry – more diverse and global than ever before. To keep up with the change, we all need high quality information, not just about current events, but also in-depth reports on the trends which are shaping our industry.

In this spirit, we have decided to make some changes as well, the most obvious of which is our name. Long time members of the International Small Satellite Organization (ISSO) will find that the New Space Newsletter provides the same in-depth coverage of small satellites, launch vehicles and other low cost space projects that they had come to expect from the ISSO Newsletter. These members will of course have the remaining portion of their subscriptions fulfilled with the New Space Newsletter. For more details about the history of ISSO, turn to page 2 of the enclosed newsletter and read a letter from our editor.

Along with our new name, we are launching a new on-line service: **The New Space Network**. Anyone with access to Internet's World-Wide Web can log in to the Network (<http://www.newspace.com/>) and browse a wide variety of information such as back issues of the Newsletter, a calendar of upcoming events, job listings, journal articles, and more. The most important feature of the New Space Network is the Industry Listings section, where quite a few forward-looking companies have set up an online presence. If your company is thinking about putting information on the Internet, I urge you to give us a call, or complete and return the form on reverse. New Space provides a simple, quick, and very cost effective way to take advantage of the marketing potential of the World-Wide Web.

If you enjoy reading this inaugural issue of the New Space Newsletter, I hope you'll consider becoming a preferred member. An annual fee of \$55 brings six issues of the Newsletter direct to your mailbox (you won't have to depend on someone else's copy). In addition you'll get publishing privileges on the New Space Network including:

Job Listings • Journal Articles • Calendar Entries • Threaded Discussion Groups

You can start your membership today by calling us toll-free at 800-636-4776, or by completing and returning the form on the reverse of this sheet. If you already subscribe to the Newsletter, then perhaps you could pass this letter on to a friend or colleague who would enjoy receiving the New Space Newsletter. If they sign up for a preferred membership, listing you as a referral, we'll add an extra six months to your existing membership. As always, if you have any questions or comments, please feel free to contact us.

Happy Reading!

Joshua Cohen, Managing Editor
New Space Newsletter

To:



by Mail

520 Huntmar Park Drive
Suite 100A
Herndon, VA 22070 USA

or Fax

+1 703-709-0790

From:

Name _____

Company _____

Address _____

City _____ State/Province _____

Zip (Postal Code) _____ Country _____

Phone _____ Fax _____

E-mail _____

*Referred by _____
(if you were referred by a current New Space member, write his or her name above)

☐ **Yes!**

Please start my preferred membership, including
six issues per year of the New Space Newsletter,
delivered to my mailbox.

- ☐ \$55 - one year ☐ check enclosed
☐ \$100 - two years ☐ please bill me
☐ \$5/yr for mailing outside the United States

☐ **Yes!**

I am interested in getting my information listed on
the New Space Network. Please contact me
with the details by:

- ☐ phone ☐ fax ☐ e-mail

launcher, and is continually being pushed toward lower prices. The end result is some difficult choices as far as which tests are absolutely necessary, and which could be forgone in favor of a less expensive engineering solution. Aerodynamic testing on the original Pegasus rocket was in close agreement with computerized models, so it must have seemed reasonable at the time that some simple modifications to account for the extra length of the XL vehicle would do the job. It was a gutsy decision which ended up coming back to haunt OSC.

Almost one year later came the second failure. On June 22, 1995, carrying the Air Force's STEP-3 satellite valued at \$26 million, the second launch of the Pegasus XL ended with destruction by the Range Safety Officer at approximately 150 seconds into the flight. The interstage between the first and second stages failed to separate, confining the second stage nozzle's freedom of movement and causing the Pegasus to lose control. A Failure Review Board is being set up with members from OSC, NASA, USAF, and the Aerospace Corporation. Laura Ayers from OSC said they hope to find the problem within a month and that OSC is on the fast track to get the XL operating soon. However, an official at Goddard Space Flight Center said NASA may look at the design of the Pegasus from the ground up, checking every component. In addition, Alan Sherman explained he is concerned about the process involved in the construction and integration of the vehicle. This could have led to the malfunction which doomed the second XL launch. He noted that after a visit to the OSC facilities at Vandenberg, he was unsure whether adequate quality controls were in effect during manufacturing and integration. OSC says they are very concerned about quality and safety controls, and that they looked into the process as well as the design after the first XL failure.

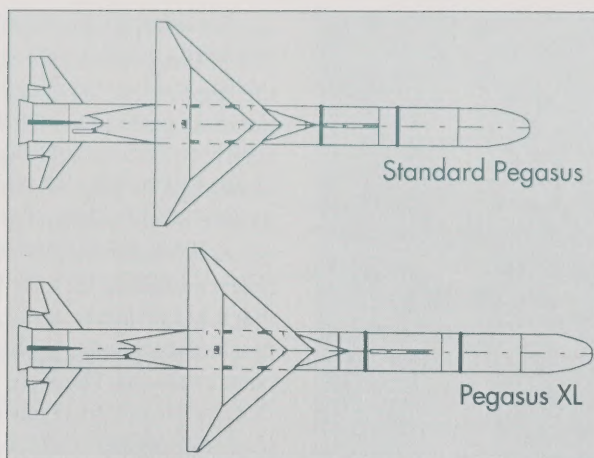
Again, simply blaming the entire failure on OSC quality control does not tell the whole story. In the

past, vehicles with stringent quality control have failed for the craziest reasons... like a rag left inside a fuel tank. Even given unlimited time and money, it is simply not possible to regulate and document the actions of every employee and contractor working to manufacture and integrate a launch

vehicle. OSC has gone through process reviews in the past, and it seems likely that there will be additional scrutiny placed on their manufacturing and integration operations in the wake of this second failure. There is always room for improvement in any manufacturing process. OSC's future success with the Pegasus vehicle will depend on their ability to quickly implement the controls necessary for the success of the vehicle, while resisting controls that would cause large cost and schedule increases for negligible reductions in risk.

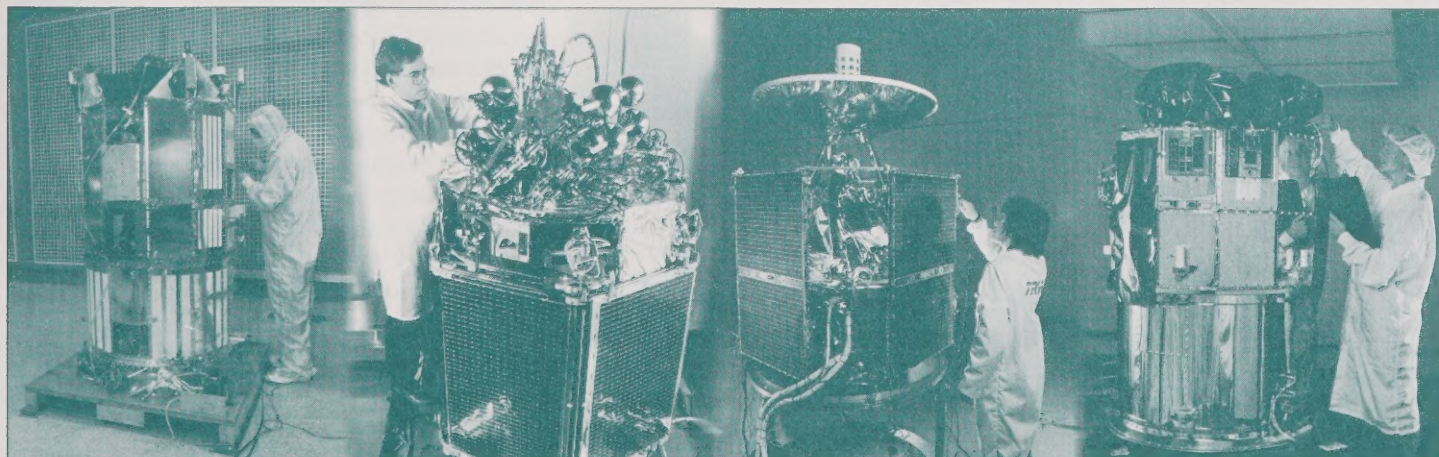
NASA's situation now is somewhat unclear. Legally, they may or may not be bound to the OSC contract. OSC has not yet violated the terms of the contract, as no NASA payload has at this time missed its launch date. According to Lawrence F. Watson, Chief Counsel at Goddard Space Flight Center, NASA could back out due to "anticipatory repudiation", a legal term which gives someone the right to renege on a contract if the party deems that the other party will not be able to fulfill the terms of the contract.

Realistically, however, Pegasus is the only dedicated small launcher on the market that has flown. Other proven small launchers such as Scout or Minuteman which could be utilized for this size payload are no longer on the market due to the



The relative sizes of OSC's two versions of Pegasus are shown in the schematic above. The standard Pegasus is 591.9 inches long, while the Pegasus XL measures 665.1 inches, or about 12% longer.

All four of the U.S. Air Force's STEP series of satellites (shown below) flew on OSC vehicles. STEP-0 and STEP-2 were launched on a Taurus and standard Pegasus respectively. STEP-1 and STEP-3 both flew on Pegasus XL and failed to reach orbit.



STEP-0 (TAOS)

STEP-1

STEP-2

STEP-3



The Lockheed Launch Vehicle (LLV) "Pathfinder" is an inert engineering model of the company's commercial LLV-1 booster. In the picture above, it is standing on the launch mount at Vandenberg Air Force Base's Space Launch Complex 6. At press time, LLV-1's maiden launch was scheduled for July 25, carrying GEMstar-1, a small communications satellite built by CTA, Inc. for Volunteers in Technical Assistance (VITA).

OSC's L-1011 jet (pictured below) has been retrofitted to accommodate a belly-mounted Pegasus rocket.



success of Pegasus in capturing contract awards. The NASA payloads are designed specifically for the Pegasus due to NASA's focus on the Pegasus as *the* small payload launch vehicle. Other options, such as the Lockheed Launch Vehicle (LLV) and Conestoga, or piggybacking on the Delta or Ariane, would take an expensive redesign and require abandonment of the Pegasus launcher. Sherman said he feels the Pegasus can work, and that it has certain long-term advantages such as cost and integration time over other existing launch vehicles. There currently is no alternative to OSC for NASA, and Figueroa feels that unless something drastic happens, at least the upcoming four Small Explorers (SMEX's) will fly on the Pegasus. Sherman wants to first send up "Peg-Stone", which is basically a lump of metal that Goddard developed with some telemetry, power, communications, and data systems in it. If it can be successfully launched, the Fast Auroral Snapshot Explorer (FAST) would go up immediately, since its launch window closes in mid-September. Unfortunately, getting off two Pegasus XL launches by September seems unlikely considering it took nearly a year to re-fly after the first Pegasus XL failure. Although NASA has put out a Request for Information (RFI) on alternatives for the Pegasus, the time to develop a new launch vehicle is simply too long, with satellites backing up waiting for launch. If NASA is planning on using the Pegasus for its launches, why is it putting out an RFI? Firstly, Sherman said, it is to put pressure on OSC. They must get Pegasus working. Secondly, it is to look for alternatives in the long term for the small launcher industry.

NASA's current policy is to buy a block of multiple launches from one launch service provider. OSC presently offers the only small payload launching service, but that is not for lack of interest from other parties. NASA consciously established OSC's Pegasus as the exclusive small payload launch vehicle by awarding OSC contracts for all its launches in that payload class. Without assurances of launches, it is nearly impossible for another company to develop a launcher due to the high costs of launch vehicle development. It is in NASA's interest to help OSC fix Pegasus, both for its own satellites and for the space industry as a whole which NASA supports. However, NASA can

no longer afford to count on just one company for its satellite launches. NASA and other launch services customers have learned an expensive lesson: Don't put all your eggs in one

basket. There must be other alternatives and options for every launch vehicle. Industry knows this already; the huge constellations of communications satellites in development such as Iridium and GlobalStar plan to use several different launch vehicles to fly their satellites. GlobalStar is using 3-3-1, three Deltas, three Zenits from Ukraine, and one Long March. The launch vehicle market must be diversified to ensure available services and to spark competition within industry.

How is this done? Some means being looked into by NASA, Figueroa said, are smaller multiple contracts and standardization. Instead of offering one large contract for numerous launches, NASA may establish two or three contracts for fewer launches, each with different companies. Each launch service could be custom matched to the needs of its missions, and each vehicle would serve as a backup for the other ones if a failure occurs. Standardizing the interfaces between payload and vehicle would allow this to be more easily implemented, and would result in savings all around. There are already a number of companies who might take advantage of such multiple contracts. Lockheed's LLV, and EER's Conestoga are both slated for inaugural launches later this summer. The U.S. Minuteman and Russian Start have flown hundreds of times as ICBM's and have already been tested as orbital payload delivery systems. These vehicles, like Pegasus, are based on solid rocket motor technology. However there are a number of companies proposing alternative technologies that could turn into viable orbital launchers in the longer term. For example, Amroc has tested hybrid rocket engines which could become the basis for a new breed of launchers. Although lack of financing has clouded Amroc's future, the hybrid technology that they have pioneered continues to be a hot R&D area for industry. Lockheed Martin is currently leading an effort aiming for static tests of several powerful hybrid boosters by 1998. On a smaller scale, two other companies, AeroAstro and Kistler Aerospace, have begun construction on suborbital demonstrators which are slated for flight in 1996. Their vehicles, the PA-X, and the K-0 are both liquid fueled, the latter being a reusable rocketship. This list is far from complete... there are a host of good ideas out there, both in the U.S. and internationally, just waiting for the opportunity to develop the next orbital launcher.

For these ideas to come to fruition, some means must be found to develop expensive new technology such as launch vehicles without bankrupting the companies developing them. Partnerships between NASA and industry where development costs are shared, such as the X-34 reusable launch vehicle program (a partnership between NASA,

OSC, and Rockwell), are being considered by NASA. A design certification process (more scrupulous than the present design reviews) from the early stages through to the end may also help launch companies compete, if those costs were shared also. It would save expensive design reviews after failures by attempting to ensure failure-free operation at every step in the design and development process. However, failure-free operation may be impossible to achieve, and many in industry do not feel that this certification would do anything but increase the complexity of the design process. Advantages and disadvantages exist within all these options, but some change must occur in order to diversify the launch industry. As the space program evolves and launches become more and more routine, reliability may become even more important than costs. Launch systems must strive for simplicity, functional redundancy, and the ability to meet tolerances for payload orbit injection every time.

As for industry, many consider NASA's safety and quality standards cumbersome and much more strict than that of other industry customers. Ayers said that while OSC is also very concerned about quality standards, industry has some leeway in setting safety guidelines. While some of NASA's standards may be too constrictive, some may not. Lessons can be learned from some of these thorough safety checks, which test components not just in normal operating conditions but also at extreme ones. A balance should be found between too many and too few safety and quality checks. Pushing the envelope to get every ounce of power and performance may not be the best idea, as a margin for error in performance will give increased reliability. NASA and others will not count pennies to the sacrifice of everything else. Industry can look to increased competition in the launch vehicle business, as NASA tries to ensure it has several options for each class of payload.

The Pegasus saga is not yet over, and only time will tell what happens with the winged rocket. Already many lessons have been learned. The launch industry must diversify, and competition will do nothing but become more intense. Industry can expect changes which will allow them to develop this new technology. Safety and quality standards will hopefully find some balance between reliability and low costs, so that launch systems can eventually reach a level of increased dependability, competition, and routine operation. Standardization may allow for a broader launch capability in the United States, where new launch vehicles can backup each other. Throughout this story, the lessons to be learned are reshaping the launch vehicle industry as we enter the 21st century.

... "News", from page 1

While some may see the downsizing aerospace industry as a poor place to invest, Frank DiBello of SpaceVest is not deterred. "The space industry as we define it is not downsizing," explains DiBello. "The largest players that do business with government may be downsizing, but it's the small to mid-size companies that represent most of the technological application and promise of the space industry, and that's where we are investing."

Alaska moves ahead with spaceport plans

Alaska Governor Tony Knowles signed a bill enabling up to \$25 million in financing to develop the Kodiak Launch Complex (KLC) and the Fairbanks Satellite Ground Station Spacepark (FSS). This authorization adds to previous funding from federal, state, and private sources that has sustained the site selection, design and environmental work for the last two years.

Project leaders at Alaska Aerospace Development Corporation (AADC) cite many advantages of the proposed launch site including:

- Safe, nearly unobstructed, Polar launch zones from the KLC
- Non-stop cargo service to both Europe and Asia
- High satellite flyover rates – Fairbanks gets as many as 12 per day
- Communications infrastructure and engineering talent available locally

Design of the KLC is nearly complete – ground breaking is planned for Spring of '96, leaving enough time to finalize environmental documentation, and permitting. Contrary to a popular concept of arctic weather throughout all of Alaska, Kodiak stays fairly mild even through the winter. The seaside temperate climate moderates the yearly mean temperature to 42°, and keeps winter snows

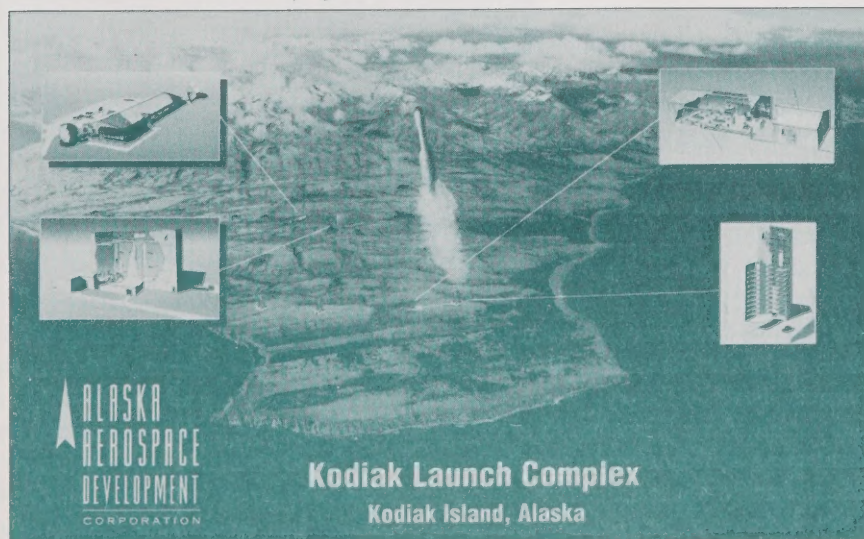
continued on page 12...

An artist's rendition of the operational KLC has been composited with an aerial photograph of Kodiak Island. Inset pictures are (clockwise from upper left):

- Launch Control & Management Center (LCC)
- Integration Processing Facility (IPF)
- Payload Processing Facility (PPF)
- Launch Pad (LP)

For more information, contact:

*Laura Gould, AADC
tel: +1 907-561-3338
fax: +1 907-561-3339*



A Wrinkle in MicroSpace

PART 3

BY RICK FLEETER

In previous episodes...

Are goats smarter than people? One reader who ought to know has confirmed at least that they outpace sheep on standardized tests (see for yourself, just look around the room at your next Princeton Review course). Thanks to one goat especially talented in trans-cave and inter-world navigation, Harel, Jennifer and Rick have discovered that if small satellites are the independent variable, the dependents

include better peaches, cleaner air, the number of people who (don't) die in automobile, hiking and hunting accidents, and the way we figure the best route into the office in the morning. This installment adds two more to the list: quality of health care in the Indonesian archipelago and electric cars. Now, thanks to Dr. Harry Lee, a retired federal air and space guy with plenty to say, our three intrepid voyagers

onto another Riemann sheet have arrived at Rick's brother's medical office. The local maps, Harry's stories, the phone book and a drive through Reston convince them they're definitely not in Kansas anymore. At the medical office, Tom does not realize at first that he's talking to a different Rick, but with the press of patients to see, the 3 get a 30 minute pre-lunch break to explore a little of this new world and to strategize...

...now, on with the story!

Tom had left us with a few minutes for exploring, so we walked over to the main street and then to the Town Center. Not too much seemed different. Even the cars were familiar – mostly. But among the Fords, Chevys and Toyotas were some very strange vehicles. Boxy structures, lousy aerodynamics and no obvious place for an engine. Har'el said they were probably electric – silent when stopped at a light and no exhaust pipe. The lack of any exhaust smell, even in a mix of conventional and electric cars in the heavy Reston Parkway traffic was very noticeable – a lot like when smoking was banned on the airlines. Jennifer wondered if this world had a better battery technology.

"Maybe they do, but I have a different theory. This society is serviced with really abundant environmental feedback from space. Remember Hilary's story about their lawsuit. My guess is these people recognized the need to clean up the environment – the satellites made it clear just how big a mess people were making of their precious air and water. Once the need is clear, the innovators can take over. Look, already in our world we have electric cars that easily go 100 miles on one charge. Nobody commutes farther than that. And we all park at offices with electricity – but nobody is set up to let you recharge during the day. We don't have a technology problem even in our world. We are just limited in our desire to improve. This world is much more aware

of what effects it is having on itself, it has feedback. And that fuels motivation and ultimately innovation. That rapid feedback loop is the difference." This being just a minor variation on one of my standard refrains, the other two politely ignored me as we wandered back to the hospital

My brother was (as usual) late, so we strategized. Neither Jennifer nor Har'el had any friends or relatives in the area who would necessarily or even probably be here in this alternative world. Jennifer's family was in Rutland – she lived here with college friends and their friends. And Har'el's was scattered everywhere between the Middle East and Hawaii. It sounded like a major undertaking to track any of them. Outside of Tom, I doubted I would know anyone in

tibial fracture. It's like 2 AM and this guy drags his leg in – under his own power. Motor-scooter accident. Must have been, drunk – do they drink there? The night nurse sent me over some crummy x-rays via the satellite, but they, along with her description, were good enough to stabilize him for tonight. I sent orders for the views I'll need to finish up. He'll get 'em in town on Monday and e-mail 'em to me."

"So they have an Internet link way out there?" Har'el asked.

"Not quite," Tom was a little sarcastic. "If you have a phone you are overqualified for this service that I volunteer for. It's some satellite thing – remote clinics have a little satellite ground station run off a laptop. They have a scanner for x-rays, and a voice

thing to narrate the pictures. Doctors in the rest of the world volunteer in various specialties at various times. The network routes the data to the right specialist who is on duty. Pretty clever."

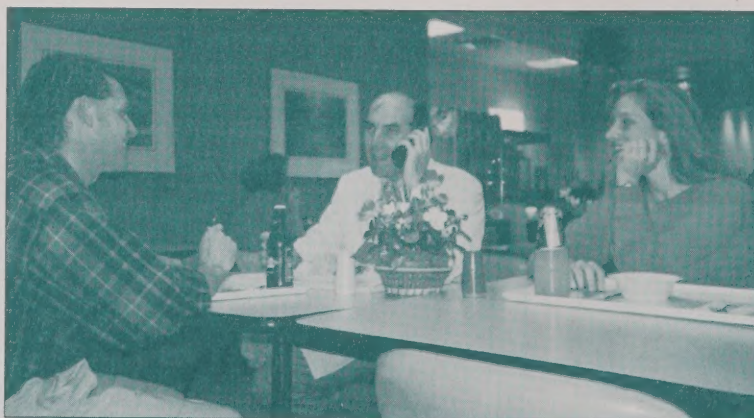
Figures, I thought. I spend my life trying to convince people to use small satellites and one Reimann sheet away, they are everywhere. I could have followed a goat through that cave 10 years ago and

saved myself a lot of trouble.

"Should we get something to eat?"

"Great. But just so you know, we don't have money with us – it's your treat. Ok?"

Tom grunted. He's used to having a flake for a younger brother. When we got back to the table with our trays, I broached the subject. "Listen, Tommy, what we need to



this area either. We realized we were total strangers right in our own neighborhood.

When Tom finally arrived he apologized for being a bit late. "I'm the orthopedic specialist on call on the 'net this week and just as I'm leaving an e-mail pops up from a clinic out in Indonesia someplace. Not where you want to be with a compound

talk with you about is pretty serious and pretty bizarre. You will think we are crazy, but please, give me a chance to tell you the whole story."

Tom just sat and soaked up our story. Regular interruption being more his style, I was worried. Probably he thought I needed a psychiatric referral. In fact, reviewing the last 24 hours out loud, I was tending toward about the same diagnosis. We leave a company outing to follow a strange goat into a cave, wherein we almost die. Ok, that could happen. We are met, on emerging, by a woman on horseback with a satellite telephone.

"Big deal," says Tom, pulling a similar phone from his shirt pocket.

"And they had wireless e-mail and weather forecasts. Even their newspaper came by e-mail."

"Yours doesn't?" Tom asked.

I replied with my own question, "Do you have a gadget in your car to show the traffic speed on your route?"

"If I didn't and I ended up late to an emergency call, do you think I might get sued?" was his rhetorical comeback.

Until this moment, until hearing the combination of impatience and worry in his voice, I thought that we three were normal and this new world was alien or illusory. Now I realized... This world is normal and we are aliens.

"Ricky, you don't remember that you are in Virginia for a test launch for your company? You launch rockets out of Oregon some place."

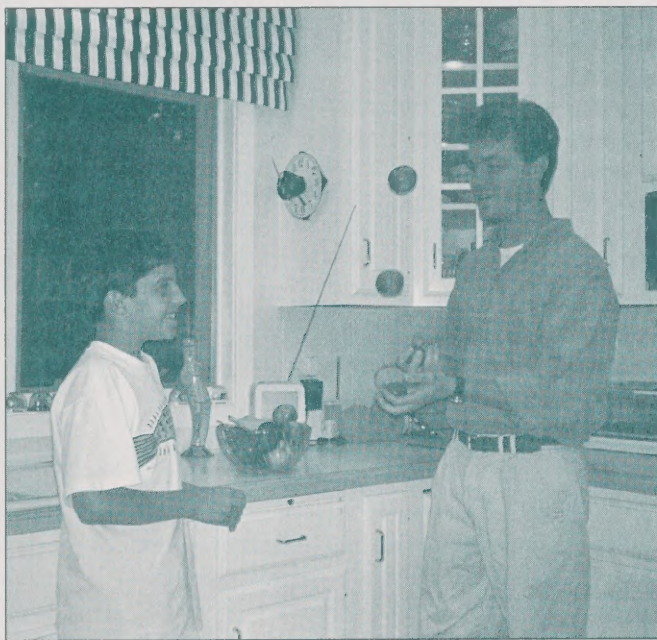
14 years growing up with Tom have provided me certain highly sharpened instincts – one of the less useful being arguing with Tom, and I blurted out "No! I build satellites right here in Herndon." He glared at me.

"Look, if I'm crazy, ok. But what about these two?" I gestured toward Jennifer and Har'el. But Tom didn't know either of them, and they looked as dirty and disheveled as I must have. I was losing ground fast.

"Tom, my thinking is up till about '70 or '71 things were the same. You remember the pink linoleum table with the fluted steel edge in the kitchen when we lived on Throckley? We had a tree house in the back. You played clarinet in the Wiley Junior High School marching band. We

called in that great swim meet spoof to the Cleveland Plain Dealer in '69." None of these details of our shared childhood impressed Tom. He knew I was his brother – if I were just an impostor with my facts skewed, he wouldn't be so worried.

Tom was silent and sullen. I think he believed I had been reprogrammed by my



younger companions. or I had snapped. In any case, I was in need of serious psychological help, and Tom, who practices a very tangible type of medicine, knows that not everybody with that type of illness gets better.

Suddenly, I had an idea. "Hey, Tom. The Rick Fleeter you know – where is he today? Didn't you say he was in the East on business?"

"Yeh, launching a test rocket somewhere on the Virginia coast."

"I'm the orthopedic specialist on call on the 'net this week and just as I'm leaving an e-mail pops up from a clinic out in Indonesia someplace. Not where you want to be with a compound tibial fracture..."

"Great. Call him up and see if he'll come by your house for dinner. Put us together face to face and I bet we can make some sense out of this mess."

Tom said nothing. He pulled his phone out of his pocket and punched a few numbers. "Hello Rick? Tom. How's it going with the new rocket?...Good... Yeh, great flying weather, I guess... Yeh... Hey, any chance you could get up here for dinner? I

know, you're trying to get back today... well, look, it's pretty important, worth putting off the trip back. If you can make it up here... yeh, you can stay overnight at our place and fly home tomorrow from Dulles. I know it's painful – but trust me – it'll be worth the extra day... Great...

Everybody'll be glad to see you. You want me to call Kathy?... Ok. See you around six."

"Who's Kathy?" I asked innocently.

"Your wife."

"Do I have kids, too?"

"Two little girls."

"Great. Hope I meet them some day."

Tom lightened up, knowing his real brother was apparently ok, whomever I might turn out to be.

"You guys are kind of a mess. I've got surgery this afternoon. Do you want to get cleaned up at my house and I'll meet you there tonight?"

"That would be great," we chorused.

Tom lead us to his car and drove us to his house. he intro-

duced us to the housekeeper, Rose, who greeted me with a warm, "Hi Ricky." Not surprisingly I was an excellent likeness of myself. Rose gave us sweats to wear while she laundered our clothes. We showered and Har'el and I shaved. By the time Tom's wife and kids showed up, we looked and felt virtually human.

"JoAnne?" I recognized her immediately. History diverges for 7 or 8 years but Tom ends up marrying the same woman. The power of self determination – Tom

lived a much better planned existence, I repeated to myself

"Hi Ricky"

"Hi Jo. Did Tom tell you we would be here for dinner?"

"Yeh. 3 of you?"

"One more is arriving around 6." We helped Joanne and Rose in the kitchen and played with the 4 kids, Josh, Joel, Jane and Jennifer (the girls were twins), until Tom

and Rick walked in together around 6:30. They had pulled into the driveway at the same time, and apparently Tom hadn't said anything to Rick. I greeted them and, as weird as this was, the surprise was a welcome relief to Tom and the three of us. Clearly I was neither demented nor reprogrammed. Cloned, maybe, but not crazy.

"Rick Fleeter?" I asked my double, staring at me in the doorway. Rick was in jeans, a broad-striped cardigan and what looked like a cross between running shoes and hiking boots. He wore a pager like Tom's on his belt.

"Yeh – and who are you?"

Half kidding I said, "Back where I come from, Rick Fleeter."

"And where do you think you come from?" this version of me was coming off a bit belligerent.

"Cleveland, originally, but the last 8 years, Reston."

Tom interrupted "Sounds pretty wild but he seems genuine – knows all the details of the family, way back to the '50s."

Rick's expression showed mixed anger, frustration and suspicion. I wished Tom had filled him in.

Har'el spoke up. "Look, the last 24 hours have not been exactly a picnic for us either. Could you two please try to figure this out instead of just glaring at each other? Tell you what... I'll pick a year and one of you tell the other what you remember, Ok?"

Starting around 1960 Rick and I recalled all kinds of trivia. School teachers, piano and cello recitals, swim meets, even the first time he, or should I say we, kissed a girl.

In a few minutes it was clear we shared one life. Rick's suspicion gave way to curiosity – and everyone joined in with Har'el's game over dinner.

Finally we came across a major schism. Early December, 1971 we were a high school senior and I remembered flying to Providence to spend a long weekend on the Brown campus hosted by the swim team, which was recruiting me. At first, Rick didn't remember Brown at all. Then an old recollection came to him.

"Yeh. I did apply there. But '71-'72 was that super cold winter. Providence was shut down and I couldn't fly in. Same thing with New Haven. Remember we wanted to go to

Stanford but Mom & Dad said it was too far away? I just pointed out that if I went there, they could come visit me and at least escape the cold. They relented enough to at least go look. We all went and seeing how beautiful and warm it was, and it's a great school..."

"I know," I interrupted, "I did my Masters there in '77. But I came from Brown and later went back to Brown for my PhD."

"No, I went to Stanford and just stayed on for the Masters – did it the same year – '77."

"So what'd you do after that?" we asked each other in almost perfect unison. We laughed. Everybody laughed.

Har'el's game had worked. My credibility as a, if not the, Rick Fleeter was restored and we all began enjoying the novelty of the bizarre situation.

Dessert was a truly excellent selection of fruit. I started munching on some melon while Rick told us about his career. Like me, he had wanted to work in aerospace but unlike me, his luck in finding space work, even with the Stanford degrees, was poor. Through a Stanford Prof's recommendation he went to Boeing where there was a propulsion group with some interest in rockets. It would be a holding pattern, since in post Nixon, post Vietnam America there was basically no space program. But it was a start.



As it turned out not a very auspicious one – six months to the day after Rick and his wife Kathy had come to Seattle, a VP met with all the members of the group and told them the company was closing down its rocket operations. "Our whole group was pink slipped right there." Rick still seemed wounded by what happened. "A couple of us headed down to the cafeteria. Munching on our cherry popsicles we

talked about what could have been – proposals we had made to Boeing management to make the rocket business a commercial success like the airplane business."

"I guess that would be like advising IBM to get into personal computers back in the days before Apple." I was both reinforcing Rick's feelings but also checking history. The PC movement was apparently either underway or inevitable by the time our histories diverged.

"Worse than that," Rick clearly enjoyed recalling his company's shortsightedness. "You think of Boeing as this paradigm of American commercial success. That is the company's PR image – carefully groomed to maximize favors from Congress like R&D grants, government financing for their customers and legislation protecting them from foreign competition. And that is over in commercial aircraft. The military planes and rocket guys honestly believe the CBD is a commercial marketplace. They didn't see the government buying any rockets in CBD and concluded there was no market for them." [*Commerce Business Daily (CBD) publishes government procurement needs for anything from Mil-Spec peanut butter to satellites. -ed.*]

While Rick nabbed a few hunks of watermelon I remarked that in 15 years working in our aerospace world, that was not just business as usual, but really the only way to stay in business.

"My world too," he agreed.

"Back then we were radical – or really just naive. Whatever we were, three of us moved down south of Portland where we could live cheap, borrowed about \$100k for expense money and opened not a rocket company, but a high speed freight transportation company. We got hold of some surplus missile stages, and mated one of them to a liquid upper stage to make an ultra cheap two stage rocket. Really an ICBM too

heavy to get to orbit, but we could toss a few hundred pounds half way around the earth. Our marketing plan was based on rapid freight delivery to Australia – a straight shot from Portland and I had some friends over there. We built the rocket and made arrangements to parachute the upper stage and payload onto the huge Woomera range. But we didn't have a single customer."

"Wait a minute. Three of you you built a couple of two stage rockets for \$100k? Just a guidance system could cost that much."

"We borrowed that first \$100k, we all invested our savings, probably another \$100k or so, and we all worked on it for about 2 years without pay – that's probably worth over a half million right there."

"Yeh, but what about parts? You needed an engine and tanks, valves..."

"We did it all on surplus stuff and contributions. The engine was a NASA '60s era design. We scavenged the last two from a storage shed inside the old NASA Lewis campus at Cleveland Hopkins Airport. The government even paid us a few cents per pound just to haul all that old scrap outta there. I drove my pickup round trip Portland to Cleveland for that stuff."

I looked at this Rick Fleeter sitting across from me. Were we really 2 incarnations of the same person? Our faces, hair and eyes were identical. We were the same height. But Rick must have weighed 10 or 20 pounds more than me, his voice and clothes and skin were rough and weathered. Even his manners were coarser. And he was more aggressive – or his aggression was at least not so well disguised. His pleasure in frugality, though, was very familiar.

"You have 2 daughters?" I was continuing my train of thought, not his.

three of us moved down south of Portland where we could live cheap, borrowed about \$100k for expense money and opened not a rocket company, but a high speed freight transportation company.

"Rebecca and Emily. Six and four. And a boy due next month. Maybe we'll call him... Peter."

Everyone smiled at this little inside joke based on a family myth that my father had named me Peter, Peter Fleeter, but Mom made him change it to Richard.

"And what about Kathy?"

"She supported us all those years working as a visiting nurse in rural Oregon. Now it's my turn to work and she's mostly home with the kids. She goes in to

the community hospital a couple of shifts per week now just to keep up with the field and get a break from home."

I thought about my first wife who had supported me for a while, also working as a visiting nurse, but in rural Rhode Island. But I wasn't driving to Cleveland in a pickup truck in pursuit of a dream to build a



rocket and to make good on an apparently ill-chosen career path. No, I was pursuing a dream to be a real scientist doing a PhD in Thermodynamics. And running away from a mainstream aerospace career which in my world was reasonably attainable but totally undesirable. A life of meetings, presentations, program reviews, writing program requirements documents and using only ancient Mil-Spec components.

Our two lives were definitely woven on the same loom. But different thread ran into the machine and the product had a totally different color and texture. I was

mesmerized following the road not only not taken, but not even on my map. "So you were saying you guys actually built a couple long range suborbital rockets to move freight to Australia?"

Rick paused, and got one of those "it's a long story" looks on his face, as he was undoubtedly pondering where he should start. A moment later, he began slowly, to relate the tale.

I traveled all over the U.S. promoting the service. People thought it was a good

idea, but nobody bought a ride. Probably it was the price: \$5 million for 500 pounds. At \$10,000 per pound it might not have been so bad, but without a customer base we needed one client to take the whole flight. For about a year we traded off – one guy would market while the others worked on the vehicle and

launch site. We aimed our marketing at the car companies, medical stuff like organ donation and international banking. Our research showed if we could save one day delivering a critical part needed to restart an assembly line, the \$5 million was a bargain.

We had taken on lots of shareholders since everything we couldn't scrounge or make ourselves we purchased with equity. Slowly they, and our families, began to conclude

there was just no market for our service. The other guys got jobs in town and I took on what consulting work I could find. At least that kept me circulating around the country so I could do some low level marketing.

Then about a year later I got a call from SpaceCorp. They were finishing a \$6 Billion proposal teamed with Bechtel to build a huge geosynch launch site at Cape York in northeast Australia... Huge project with competing bids from all over the world. Well, somebody got the date wrong and thought it was due the next Monday. It was already Thursday here and about 1 AM Friday in Australia. And now it turned out they had only until close of business Friday in Canberra – about 16 hours – to submit their proposal on time. SpaceCorp had a company jet – several, in fact, but they were still awaiting its arrival at Burbank airport in LA and then it needed 20 hours to reach Canberra.



Next issue...

If the medium really is the message, then is the transportation system the destination? Next issue, a dramatic small rocket flight has a chance at creating a place for the first rocket-based airline. But even two Davids prove no match for the Goliaths of space, fate, and finance... and vice versa. Stay tuned, wear sunscreen, and we'll see you in September. And, vice versa.

... "News", from page 7

from accumulating. Even so, AADC has gone with an "all indoor processing" design concept which will protect payload and vehicle integration from any weather related delays up to final countdown. Additionally, AADC is searching out strategic partners to participate in a ground station network centered around the FSS. Ground tracking and data processing services will be available to all potential users, whether or not the payload in question is launched from Kodiak Island.

AADC is just one of several groups working to develop commercial spaceports in North America to support the massive launch efforts that would be required by satellite networks such as Teledesic, GlobalStar, and Iridium. Other commercial sites are being independently developed in Manitoba (Canada), Florida, California, New Mexico, and perhaps even Virginia. Stay tuned for coverage of these spaceport efforts in a future issue of the New Space Newsletter.

Will the U.S. Air Force go commercial?

The U. S. Air Force Space Command is studying a possible partnership between the U.S. Government and the U. S. commercial space industry. This initiative is designed to encourage and facilitate the U.S. commercial space industry as users of the Air Force's Satellite Control Network (AFSCN). The AFSCN is a global configuration of space-ground link resources interconnected through communication links to provide tracking, telemetry, command, and control functions primarily for manned and unmanned satellite operations and space vehicle missions.

As part of this initiative, the Air Force is soliciting commercial interest in the use of the AFSCN. The Air Force is currently gathering potential commercial users of the network and the level and magnitude of that interest. Potential users would be invited to attend an Air Force Space Command open-house to announce their intent to support the commercial space industry. The open house is planned to be held in a few months.

For more information, please compile contact information (name, address, phone & e-mail) and any commercially available information about your satellite program and/or company and e-mail it to:

shanelec_sophia@smtpmac2.bah.com

or call:

Sophia Shanelec 415-960-7534
-or- Steve Wagner 415-960-7438

A Humble Space Telescope

How would you like to do your own astronomy research with a space based telescope? Sound unlikely? Perhaps today, since there's only one available, and NASA has it booked pretty solid. However, if a group of British researchers are successful, millions of astronomers worldwide will have access to a more humble version of NASA's Hubble.

The "Humble Space Telescope" would be developed as an element of a National Science Center (NSC) for public understanding of science, engineering, and technology. The NSC project is hoping to receive a £25 million grant from Great Britain's Millennium Commission which is

investing a portion of Britain's lottery earnings in preparations for a turn of the millennium celebration. If the project comes to fruition, the control center of the Humble Space Telescope would be a major attractions to hundreds of thousands of annual visitors to the NSC. If funded, Humble will be on track to be operational in late 1999.

However, use of the telescope would not be limited to visitors of the museum. Students and amateur astronomers worldwide would be able to submit their own observation requests via Internet. These would then be merged into an observation program, in a similar (although more automated and less formal) manner as the process that is now used for NASA's Hubble Space Telescope. Once the observations are carried out, the results would be returned to the investigators automatically.

The NSC project team is hoping to secure a bit of seed money from the UK Particle Physics and Astronomy Research Council (PPARC). Part of the grant would be used to contract Surrey Satellite Technology Ltd (SSTL) to perform a full feasibility study of the miniature space telescope. It is expected that that the satellite will be a bit more complicated than the gravity gradient stabilized UoSAT series of satellites that SSTL has been so successful with in the past. The observation instrument will likely be a modified version of a standard telescope used by many amateur astronomers today.

Further information about the "Humble" project can be obtained from: r.buckland@open.ac.uk



<http://www.newspace.com/>

Check it out!

New Space Network Growth

